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REPORT

# of the

Army Field Forces Board No. 3

FORT BENNING, GEORGIA

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Project No. 2106

REPORT OF STUDY OF ROCKETS AND LAUNCHERS, 2.36" AND 3.5"

Date 27 April 1948

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ARMY FIELD FORCES BOARD NO. 3
Fort Benning, Georgia

26 April 1948

REPORT OF STUDY OF PROJECT NO. 2106

ROCKETS AND LAUNCHERS, 2.36" AND 3.5"

1. a. Authority: VOCG, Army Ground Forces Board No. 3, Fort Benning, Georgia.

b. Purpose: The purpose of this study is to propose M. C.'s for an interim weapon pending development of the multi-purpose weapon (OCM Item 31487). (Note: It is not intended that this interim weapon will replace the weapons which the multi-purpose weapon is recommended to replace but will augment present anti-tank defense weapons.)

2. References:

a. Paragraphs 10 and 12, Section II, War Department Equipment Board Report, 29 May 1946.

b. T16 Report of Committee A on Tactics and Technique, the Infantry Conference, Fort Benning, Georgia, June, 1946.

c. Report of The Infantry Board No. 1826-A, Subject: "Rocket, 3.5", T80", dated 29 September 1945.

d. Report of The Infantry Board No. 1867, Subject: "Rocket, High Velocity, 2.36", T59", dated 19 September 1945.

e. OCM Item 31487, 13 March 1947.

f. OCM Item 30427.

g. Letter from Commanding General, Army Ground Forces Board No. 3 to Commanding General, Army Ground Forces, dated 4 September 1947, file GNBCG 471.6, Subject: "Rocket, HEAT, 2.36", T59E3; Rocket, Practice, 2.36", T50E2 and Fuze, Rocket, PD, T2000E1."

h. 1st Indorsement from Army Ground Forces Board No. 3, Fort Benning, Georgia, 25 November 1947, to the President, Army Ground Forces Board No. 2, Fort Knox, Kentucky, file 472.8 (27 October 47) GNBCG.

i. Letter, President, AGF Board No. 3 to Commanding General, Army Ground Forces, dated 28 April 1947, File 472 (28 April 1947) GNBCG, Subject: "Higher Priority for Weapon, Multi-purpose, Shoulder Fired and Ammunition Therefor - Development of."

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3. Test Material:

None.

4. Background:

a. Upon recommendation of Army Ground Forces Board No. 3 as approved by Headquarters, Army Ground Forces, Item 31487, Subject: "Weapon, Multi-purpose, Shoulder Fired, and Ammunition therefor, Development of," was approved by Ordnance Committee on 20 March 1947. This weapon is designed to replace the following: 2.36" launcher and rocket, 3.5" launcher and rocket, and 57mm recoilless rifle. In discussion of this Item under paragraph 2f it is stated: "****A preliminary review of the project indicates that this evaluation study may be complex and extensive since no presently envisioned modification of any of the weapons to be replaced will meet the specified objectives."

This Board recognizes that the development of this weapon will be difficult and may require considerable time to effect its completion.

b. In the meantime both Infantry front line soldiers and Airborne assault units are in need of a better means for engaging armor than that presently standardized. There has been developed the T59 rocket for the 2.36" rocket launcher which is capable of penetrating 7" of armor and has a satisfactory accuracy against a fixed or stationary target at ranges up to 500 yards. There has also been developed the T-80 rocket for the 3.5" rocket launcher which is capable of penetrating 11" of armor but is not sufficiently accurate at ranges greater than 300 yards. It is recognized by this Board that both the T59 rocket and the T80 rocket involve firing a missile at a comparatively high trajectory; therefore, a correct range estimation, correct setting of sights, and good marksmanship on the part of the firer are necessary in order to obtain hits with these rockets. The Board is cognizant of the fact that a weapon firing a flat trajectory missile would not require as great an accuracy of range estimation, setting of sights, and marksmanship on the part of the firer. The Board is also aware of the fact that the present type rocket launchers are single shot weapons and are of much greater value against stationary tanks than they are in firing at moving tanks. However, the development of the repeating feature on the 2.36" rocket launcher and the 3.5" rocket launcher will permit the launching of several rockets in a comparatively short period of time and should make these launchers a more effective weapon against moving as well as stationary tanks.

c. This Board has recently reviewed the Military Characteristics for an antitank weapon for airborne assault units which were prepared by Army Ground Forces Board No. 2. These Military Characteristics call for a gun and carriage which would weigh about 8000 pounds and a shell which would penetrate approximately 6 inches of armor at 1000 yards. This Board was not in agreement with the recommendations of Board No. 2 because of the extreme weight of gun and carriage and the lack of penetrative qualities of the gun and shell to be designed. We have at the present time a projectile, the T80 rocket, which is capable of penetrating the desired thickness of armor. It then becomes a question of propelling a projectile with penetrating qualities equal to the T80 rocket to the range desired with required accuracy.

5. Discussion:

a. Since the development of the multi-purpose weapon, approved in OCM Item 31487, seems to be in the distant future, it is most desirable that an interim weapon be developed as quickly as possible to meet the urgent requirement of assault units of the Airborne Division for suitable anti-tank defense ranges beyond the capabilities of the present 2.36" and 3.5" rockets. It is contemplated this weapon might replace the 3.5" launcher and rocket in Infantry and Armored Divisions and thus increase the anti-tank defense of front line units of these divisions. This Board has been informally advised by Ordnance that it is possible to produce a rocket and launcher with greater accuracy and range than that of the 3.5" T80E2 rocket and launcher now under test and at the same time have equivalent penetration. The forecast accuracy and range is as follows: A maximum range of 2000 yards, 20% hits on a stationary tank at 1500 yards and 50% hits on a stationary tank at 1000 yards. The increase in accuracy and range is not the ultimate desired (80% hits on a 6' x 6' target at 1500 yards would be considered satisfactory) but it will be a step forward.

b. The Board again emphasizes the need for expediting the development of the rocket, HEAT, 2.36", T59E3; rocket, practice, 2.36", T60E2, and Fuze, Rocket, PD, T2000E1, as stated in its letter of 4 September 1947.

c. Present information indicates that there is no known rocket powder which will withstand protracted storage at temperatures over 100°F., without rapid decomposition and resulting in considerable hazard.

d. Likewise the present M7 powder begins to give marked variations in velocity, coupled with afterburning at from about -20 to -40°F. This powder already contains a large enough proportion of stabilizing salts to produce an objectionable smoke cloud. Hence, it appears that two rocket loadings will be required, one usable from -70°F. to +32°F., the other from -20°F. to +125°F.

e. Present basic research on rocket powders should be expedited in order to reduce smoke and to widen the temperature range.

6. Conclusions:

a. That there is an urgent requirement for the early completion of the development of the following items of rocket materiel:

Rocket, HEAT, 2.36", T59E3, and related items (OCM 30829)
Rocket, Practice, 2.36", T60E3
Fuze, Rocket, PD, T2000E1
Rocket, HEAT, 3.5", T80E2 and related items (OCM 30870)
Rocket, Practice, 3.5", T85E3

b. That there is likewise an urgent need for the development of 2.36" rockets and launchers which will function satisfactorily within Army Field Forces temperature requirements. The rocket or rockets should be capable of penetrating at least seven (7) inches of armor. The effective range should be not less than 500 yards (80% hits on a 6' x 6' target at 500 yards is desired). The fuze should be of a type which will permit optimum armor penetration. It is desirable, but not essential, that the fuze detonate on impact in soft snow and soft ground. It is essential that the fuze detonate on graze impact. (The T59, 2.36" Rocket, tested by this Board in 1945, approached these requirements in temperate climates.)

c. That there is a need for the development of launchers and rockets with the penetrating qualities of the 3.5" T80E2 rocket and launcher, and with increased range and accuracy. An accuracy and range which would give 80% hits on 6' x 6' target at 1500 yards is desired; however, for an interim weapon the capabilities forecast by Ordnance would be acceptable, i.e., a maximum range of 2000 yards, a minimum of 20% hits on a stationary tank at 1500 yards range and a minimum of 50% hits on a stationary tank at 1000 yards range. The rocket should function satisfactorily and without misfires within AFF temperature requirements. The fuze should be of a type which will permit optimum armor penetration. It is also desirable, but not essential, that the fuze detonate the rocket instantaneously upon impact in soft snow and soft ground. It is essential that the fuze detonate on graze impact on firm ground. The Launcher, Rocket, 3.5", M20 has acceptable general military characteristics. However, if a longer and heavier rocket launcher is needed to obtain the longer range and greater accuracy, it would be acceptable.

7. Recommendations:

That there be developed with high priority long range, high performance HEAT and practice rockets and a suitable launcher and ground mount in accordance with the military characteristics set forth in Appendices "A", "B", and "C".

Earle A. Johnson
EARLE A. JOHNSON
Colonel, Infantry
Acting President

APPENDICES:
"A" - M/C-HEAT Rocket, 16 pound
"B" - M/C-Practice Rocket, 16 pound
"C" - M/C Proposed Launcher &
Ground Mounts
"D" - Comments other organizations

Ap. A

APPENDIX A - MILITARY CHARACTERISTICS OF PROPOSED HEAT ROCKET, 16 POUND

1. Purpose: This rocket of unspecified caliber shall be fired from a man portable weapon and shall be capable of destroying heavy tanks at ranges up to 1500 yards. It will answer an urgent requirement of airborne units and will also be of great value to other combat troops.

2. Armor penetration shall be not less than ten to twelve inches of homogeneous armor plate at angles of impact within 30 degrees of normal. (Note: Some rounds will penetrate 12 inches, others only ten).

3. Weight of rocket shall not exceed 16 pounds.

4. Maximum range shall be not less than 2000 yards.

5. Rocket shall be capable of effecting 20% hits on a stationary tank at 1500 yards range and 50% hits on a stationary tank at 1000 yards range.

6. Although the capability of engaging targets other than armor is highly desirable, design features intended to produce versatility of use shall not be permitted to compromise the efficiency of the rockets for use against tanks.

7. Climatic requirements. Pending development of improved powders, two rockets should be developed, one for arctic warfare, and one for normal use.

a. Rocket for normal use:

(1) Minimum temperature:

(a) For operation, -20°F.

(b) For storage, -80°F.

(2) Maximum temperature for storage and operation, 125°F.

b. Arctic Rocket:

(1) Minimum temperature:

(a) For operation, -70°F.

(b) For storage, -80°F.

(2) Maximum temperature:

(a) For operation, 32°F.

(b) For storage, 125°F.

c. Both rockets shall meet humidity and barometric pressure requirements set forth in paragraphs 11 and 12, Letter, Headquarters, Army Ground Forces, 000.9 (C) (4 August 1947) GNDEV-2.

8. There shall be no after burning of propellant when the rocket leaves the launcher.

9. Smoke shall be reduced to the minimum possible consistent with temperature requirements.

10. Flash shall be held to a minimum.

11. a. Fuze must permit optimum armor penetration.

b. It is desirable, but not essential, that the fuze detonate on impact in soft snow and soft ground.

c. **It is essential that the fuze detonate on graze impact on firm ground.**

APPENDIX B - MILITARY CHARACTERISTICS OF PROPOSED PRACTICE ROCKET, 16-POUND

1. Purpose: To provide a suitable practice rocket for use in training troops in the employment of the 16-pound HEAT rocket described in Appendix A.

2. Ballistics shall be identical with those of the HEAT rocket used in normal climates.

3. A spotting charge shall be provided to permit observations of the burst at ranges up to 1500 yards.

APPENDIX C – MILITARY CHARACTERISTICS OF PROPOSED LAUNCHER AND GROUND MOUNT FOR USE WITH 16-POUND ROCKETS

1. **Purpose:** To provide a suitable launcher and ground mount for use with the 16-pound rockets described in Appendices A and B.

2. Weight of launcher and ground mount shall not exceed 75 pounds, complete.

3. Length shall not exceed 90 inches.

4. Shall be capable of being dropped by parachute and quickly placed in action.

5. The launcher and mount shall be man-portable with no individual load exceeding 40 pounds.

6. Sight shall be a straight tube telescopic sight.

7. The mount shall provide the same amount of free and mechanical traverse and elevation as that found in the Lightweight Machine Gun Mount, Tripod, T113. However, the elevating handwheel shall be made easily accessible to the gunner.

8. The weapon and its cradle shall be designed to permit mounting and firing from vehicular pedestal mounts for cal. .30 machine guns.

9. Shoulder firing is not required, but it would be desirable as an alternate means of firing.

10. The weapon and mount must operate within temperature limits as prescribed by Army Field Forces.

11. Humidity and atmospheric pressure requirements are as set forth in paragraphs 11 and 12, Ltr., Hq., AGF, 000.9(C) (4 Aug 47) GNDEV-2.

12. This weapon must be rugged, durable, and simple to operate and maintain.

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APPENDIX D - COMMENTS ON REPORTS FROM OTHER ORGANIZATIONS

THE INFANTRY SCHOOL

Par. 2. This statement has been altered.

Par. 3. The repeating feature has not been tested. It is not believed it will be suitable for a rifle company, but may have a place somewhere in the regiment.

Par. 4a. This board agrees.

Par. 4b. This change has been made.

THE ARTILLERY SCHOOL

a. Reference is made to Appendix "C". (Above)

b. Ordnance representatives claim this only adds to present inaccuracies and is not feasible.

c. This memorandum reference is forwarded for consideration by producing agency.

BOARD #1

2a. In either case, the total combined weight is 8000 lbs. The prime mover of the towed carriage weighs 5000 lbs.

2b. Change has been made.

2c. This correction has been made.

2d. This is desirable, but cannot be achieved with present "know how".

2e. Change has been made.

BOARD #2, BOARD #4

AND ARMORED CENTER

No comments.

5 Incls:
1. Comments, TIS
2. Comments, The Artillery School w/Incl
3. Comments, Board #1
4. Comments, Board #2
5. Comments, Board #4

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RES

HEADQUARTERS THE INFANTRY SCHOOL
Fort Benning, Georgia

GNKEAD-A 471.94 13 April 1948

SUBJECT: Draft of Report of Study on Project No. 2106 "Rockets and Launchers, 2.36" and 3.5""

TO: President
Army Field Forces Board No. 3
Fort Benning, Georgia

1. Reference your letter GNBCG 470.94 P-2106, 22 March 1948, subject as above, and inclosure thereto. Comments herein on specific items refer to identical items in the reference inclosure.

2. The statement of accuracy in line 2, page 3, is questionable and may be disastrously misleading.

3. The repeating feature for the launcher is not considered suitable for a rifle company because of increased weight of ammunition requirements.

4. a. Development efforts should strive for greater accuracy than that stated in the last sentence, page 5.

b. In the last sentence of paragraph 5, add "and greater accuracy" after the word "range".

FOR THE COMMANDANT:

D. O. BROWN
Captain, Infantry
Actg. Asst. Adj. Gen.

C-O-P-Y

Incl #1

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Ltr., AGF Bd. No. 3, Ft. Benning, Ga., GNBCG 470.94, 22 Mar 48, Subj: "Draft of Report of Study on Project No. 2106"
AG 400.112 GNKDAR 1st Ind.

The Artillery School, Fort Sill, Oklahoma 7 Apr 1948

TO: President, Army Field Forces Board No. 3, Fort Benning, Georgia

The following comments are submitted on Draft of Report of Study on Project No. 2106:

a. It is believed that greater accuracy may be obtained in firing, particularly at ranges over 500 yards by use of either a bipod or tripod mount.

b. Incorporation of a second or booster motor in the rocket to commence functioning after the rocket leaves the launcher and is well away from the firer would increase velocity. Data as to how this would affect accuracy is not known.

c. Attached is memorandum reference use of granulated TNT mixed with nitro-cellulose powder as propellant for a rocket.

FOR THE COMMANDANT:

2 Incls:
Added 1 Incl
2. Memo

/s/ James Barber
JAMES F. BARBER JR.
Lt Col., AGD
Adjutant General

C-O-P-Y

Incl #2

6 April 1948

TO: Lt. Col. Ross, Dept. of Analysis & Research

FROM: Captain Fogel, Dept. of Materiel

SUBJECT: Suggested Propelling Charge for Rockets

The suggestion for the possible use of granulated TNT and nitrocellulose as a propelling charge for rockets was the result of an informal experiment performed by myself during the spring of 1945 in Italy. After a class on explosives and their characteristics, I had a small quantity of granulated TNT and several charges of charge 5, Green Bag, 155-mm Howitzer, nitrocellulose propellant left. In order to dispose of these, a small quantity of TNT and nitrocellulose were mixed (the TNT in powdered form) and burned in a hole in the ground. The hole was three inches in diameter and about twelve inches deep. The pressure created was tremendous, but no explosion occurred.

A second charge, like the first, was placed in an old GMC muffler pipe about 3 feet long with pure nitrocellulose used to lead the flame to the pipe. The pressure was sufficient to propel the pipe about two hundred yards into the side of a hill. Had it been possible at the time to control the flight of the pipe and had the pipe been stronger, I believe a better range could have been obtained.

The experiment was not done to create a rocket, however, but to prove that pressure could cause TNT to detonate.

/s/ Roy U. Fogel
/t/ ROY U. FOGEL
Captain, FA
Materiel

C-O-P-Y

Incl

RE

HEADQUARTERS
ARMY FIELD FORCES BOARD NO. 1
FORT BRAGG, N. C.

471.94-GNBAA 12 Apr 1948

SUBJECT: Draft of Report of Study on Project No. 2106,
Rockets and Launchers, 2.36" and 3.5".

TO: President
Army Field Forces Board No. 3
Fort Benning, Georgia

1. Reference letter, Hq. AGF Board No. 3, GNBCG 470.94, dated 22 March 1948, subject as above.

2. The following comments are submitted:

a. Paragraph 4 c: The military characteristics, as prepared by AGF Board No. 2, call for two carriages - a towed carriage and a self-propelled gun motor carriage. As stated in these characteristics, the weight of the towed carriage complete with gun, mount, and fire control equipment shall not exceed 3000 pounds, and the weight of the gun motor carriage shall not exceed 8000 pounds gross.

b. Paragraph 5 b: Army Field Forces has stated the following operational temperature limits for weapons: "Capable of operation throughout an ambient temperature range from -65°F. to 125°F., and to air induced or radiation temperature to 160°F., and must be capable of prolonged storage throughout an ambient temperature range from -80°F. to 125°F., and induced or radiation temperature of 160°F."

c. Appendix A, Paragraph 5: This paragraph apparently contains a typographical error. It is believed that the intent is "50% hits on a stationary tank at 1000 yards range."

d. Appendix A, Paragraph 7: See comments in Par. 2 b, above.

e. Appendix C, Paragraph 10: See comments in Par. 2 b, above.

FOR THE PRESIDENT:

E. H. HOFFMAN
CWO, USA
Adjutant

C-O-P-Y

Incl #3

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